PATENT SPECIFICATION

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COMPLETE SPECIFICATION

A Centring Device for Centring Conduits and the like in Well Bores

We, BAKER OIL TOOLS INC., a corporation duly organized under the laws of the State of California, of 6000, South Boyle Avenue, Los Angeles, State of California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to centring devices for centring casing, liners, and similar conduit strings in well bores.

It is an object of the present invention to provide a casing centring device which can be collapsed inwardly to a comparatively small effective external diameter, and which allows the casing to be rotated without rotating the centring device itself.

Another object of the invention is to provide a casing centring device embodying outwardly bowed springs capable of being collapsed inwardly to a comparatively small effective diameter and of being pulled through a well bore, the centring device allowing the casing to be rotated without rotating the device itself.

A further object of the invention is to provide a casing centraliser that can be easily assembled and placed in an operative position on a casing section, or similar conduit, end which has an over-all relatively small minimum effective diameter, and which allows the casing to be rotated within it.

According to the present invention, therefore, there is provided a casing centring device having a pair of longitudinally spaced cylindrical members with circumferentially spaced outwardly bowed leaf springs secured at their ends to said members, a ring secured in axially spaced relation to each member by circumferentially spaced straps, a plurality of stops disposed between each ring and its adjacent member for securing to the casing, and in which the ends of said leaf springs are welded to said members.

One embodiment of the present invention is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is defined by the appended claims.

Referring to the drawings:

Figure 1 is a side elevation of a centraliser mounted on a casing section, with the springs occupying their maximum outward position;

Fig. 2 is a view, similar to Fig. 1, of the device disposed in a well bore;

Fig. 3 is a cross-section through the centraliser, taken alone line 3—3 of Fig. 1; and

Fig. 4 is a cross-section taken along the line 4—4 of Fig. 1.

The casing centring device A is mounted on a casing section, liner or similar conduit B adapted to be run in a bore hole C. As is well known, the purpose of centring devices is to dispose the casing B centrally of the bore hole C.

The centring device disclosed in the drawings includes a plurality of circumferentially spaced, outwardly bowed leaf springs 10, whose upper and lower ends are attached to upper and lower collars 11, 12, respectively, that are slidable upon the casing section B. The ends 13 of the springs abut the inwardly facing ends 14, 15 of the collars, to which they are butt welded. An efficient weld can be made through use of an atomic hydrogen arc, a bead 16 running along the abutting

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end of the collar and each spring, which projects but little, if at all, beyond the outer adjacent surfaces of the collar and spring. The thickness of the spring 10 is approximately equal to, and is preferably not greater than, the thickness of the collars 11, 12, to hold the effective diameter across the springs to a minimum extent, when they are collapsed inwardly against the casing B by the fullest amount.

Rings 17, 18 are disposed above the upper collar 11 and below the lower collar 12, each ring being secured in spaced relation with respect to its adjacent collar by a plurality of circumferentially spaced connecting elements 19, which may be in the form of relatively short bands or straps engaging the periphery of the collar and rings, and welded thereto, as by running a bead 20 around the edges of the connecting element 19 which overlap the ring and collar.

The inside and outside diameters of the rings 17, 18 are substantially the same as the inside and outside diameters of the collars 11, 12; whereas the thickness of the connecting elements 19 may be substantially less than the thickness of the collars and rings, since these connecting elements are only subjected to a tensile pull or strain, as hereinafter described.

Londitudinally spaced holes 21 may be provided in each connecting element 19 to facilitate assembly of the centraliser parts, and welding of the connecting elements 19 to the collars 11, 12 and the rings 17, 18, with each ring spaced from its adjacent collar by a predetermined amount. Pins (not shown) may extend through the holes 21 in the connecting straps, and the opposing ends of a collar and ring at each end of the casing centraliser placed in engagement with these pins, whereupon the straps 19 can be welded to the peripheries of the collar and ring, as indicated above, and the pins then removed.

The casing centraliser A may be placed upon a casing section B that is to form part of a casing string to be disposed in a well bore. After being placed on the casing section, circumferentially spaced stop members 22, in the form of lugs, are placed through the arcuate spaces between the connecting elements 19 into engagement with the edge of each stop ring which is opposed to its adjacent collar. That is, the stop members or lugs 22 are placed in engagement with the lower end 23 of the upper ring 17 and with the upper end 24 of the lower ring 18. These lugs are then welded to the casing section, as by depositing welding material 25 within a hole 26 in each lug 22, which integrates the latter to the casing section B.

It is to be noted that both the upper and lower sets of lugs 22 engage the stop rings 17, 18 when the outwardly bowed springs 10 are unconfined, and that there is substantial distance between each set of lugs and the adjacent collar member 11 or 12 (Fig. 1). The lugs 22 are preferably thinner than the collars 11, 12 and rings 17, 18, so that they do not project beyond the peripheries of the latter and will not engage the interconnecting strap elements 19.

When the casing centraliser has been assembled on the casing section B with the stop members 22 welded in place, as illustrated in Fig. 1, the casing section B may be connected to the other sections constituting the casing string, and the latter lowered through the well bore. During this lowering operation, the lower set of lugs 22 engages the lower ring 18 and exerts a pulling action on the interconnecting straps 19 and lower collar 12, which is transmitted to the bowed springs 10, in order to pull these springs through the well bore. Such pulling action facilitates inward collapsing of the outwardly bowed springs 10 to a minimum effective diameter. During such inward collapsing, the upper collar 11, ring 17 and straps 19 are shifted upwardly along the casing (Fig. 2). However, such upward shifting can occur without interference from the upper stop lugs 22 welded to the casing section, since sufficient space is allowed between these members 22 and the upper collar 11 when the centring device is assembled on the casing section, as is evident from Fig. 1.

Similarly, upward movement of the casing string B causes the upper set of stop members 22 to engage the upper ring 17, to exert the pulling action on the straps 19 and outwardly bowed springs 10, in order to facilitate their passage through restriction in the well bore, without buckling and breaking. During such upward movement, the lower collar 12 may shift toward the lower set of stop members 22 without interference, in view of the initial space allowed therebetween.

The minimum diameter of well bore C through which the casing centraliser A can pass is determined by the extent that the interconnecting strap elements 19 project beyond the peripheries of the collars 11, 12 and rings 17, 18. Since these straps have only a tensile load imposed upon them, they can be made of comparatively thin metal. Their thickness is much less than the thickness of the collars and rings themselves. Accordingly, the minimum effective diameter of the casing centraliser

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This drawing is a reproduction of the Original on a reduced scale.

FIG. 1.

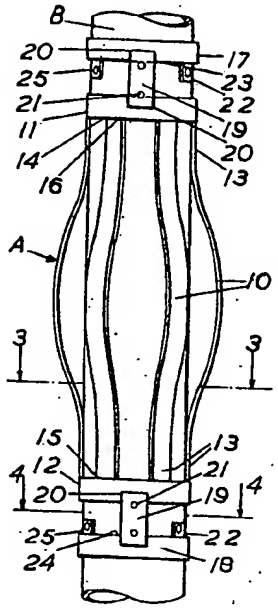


FIG. 2.

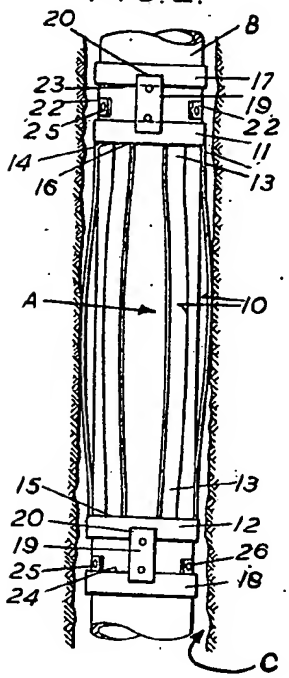


FIG. 3

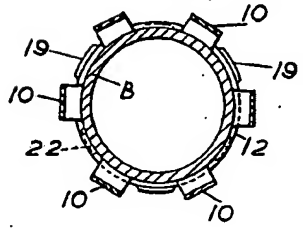
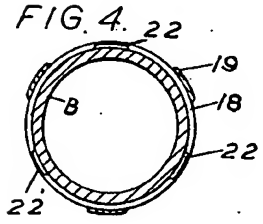


FIG. 4.



is but very little more than the external diameter of the collars and rings themselves.

There are no elements disposed within the outwardly bowed springs 10 which will deter or interfere with their complete collapsing against the casing section. Accordingly the centring device can be run in well bores, such as "slim" holes, that have only a slightly greater diameter than the full collapsed diameter across the outwardly bowed springs.

It is also to be noted that the arrangement allows the casing string B to be rotated within the casing centraliser A, and without rotating the latter. This latter action, if it occurred, would drag the springs 10 around the wall of the well bore, scraping drilling mud and formation material from the latter, and also possibly damaging the springs. There are no elements in the present casing centraliser interfering with rotation of the casing section within the centring device. The stop members 22 can slide freely along the stop rings 17, 18 and collars 11, 12, and since they do not project beyond the periphery of the stop rings and collars, they can pass freely under the interconnecting strap elements 19.

It is, accordingly, apparent that a simple and inexpensive casing centraliser has been provided, capable of use in "slim" holes, and in which the outwardly bowed springs 10 are pulled through the well bore upon longitudinal movement of the casing string through the well bore in both directions. In addition, the casing string can be rotated without rotating the casing centraliser.

What we claim is:—

1. A casing centring device having a pair of longitudinally spaced cylindrical members with circumferentially spaced outwardly bowed leaf springs secured at their ends to said members, a ring secured in axially spaced relation to each member by circumferentially spaced straps, a plurality of stops disposed between each ring and its adjacent member for securing to the casing, and in which the ends of said leaf springs are welded to said members.

2. A casing centring device as set forth in claim 1, in which said rings and members are slidably mounted with relation to the casing.

3. A casing centring device as set forth in claim 1, in which said stops are circumferentially spaced and engageable with the inner end of said rings to exert a pulling action on said springs when the device is inserted in a well bore.

4. A casing centring device as set forth in claim 1, in which said stops extend outwardly from the casing no farther than the peripheries of said members and said rings so as to avoid engagement with said straps and permitting rotation of the casing without rotating the centring device.

5. A casing centring device substantially as described and shown in the accompanying drawings, and for the purpose set forth.

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